(12)   **EUROPEAN PATENT APPLICATION**

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(54)   **Machine for orientating and applying sealing capsules to bottles of sparkling wine and the like**

(57)   A machine for orientating and applying sealing capsules to bottles of sparkling wine and the like comprising means (11-12) for moving the bottles and a plurality of processing heads (19-20) adapted to perform in succession the operations for orientating and applying the capsules by forming and smoothing folds; at least one optical reader cooperates with the orientating head (19) and stops a corresponding rotatable bottle orientation pan (12) when an angular reference marking, provided on the capsule (C) fitted over the bottle, is aligned with the optical reader. The optical reader is constituted by an artificial-vision means (30), adapted to acquire and recognize an image (i) drawn on the capsule and acting as an angular reference marking.
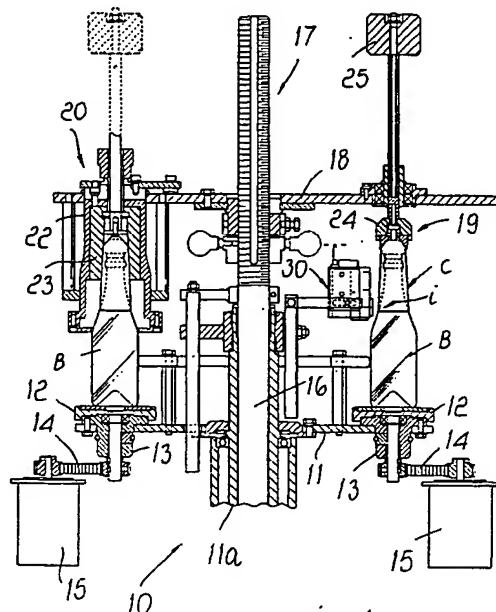
Fig. 1

EP 1 197 468 A1

Description

[0001] The present invention relates to a machine for orientating and applying sealing capsules to bottles of sparkling wine and the like.

[0002] More particularly, the invention relates to machines for orientating and applying capsules made of metal or metal alloy, typically a material known as polylaminate based on aluminum. As is known to those skilled in the art, such capsules are applied by fitting them over the neck of the bottle, to which they are then made to adhere by means of pneumatic heads comprising elastomeric sleeves actuated by compressed air, inserts and the like, which constrict the capsules, forming thereon a plurality of parallel and vertical folds which are then smoothed or clinched and are adapted to take up the excess material of the capsule and achieve its correct adhesion to the bottle neck.

[0003] In order to correctly perform the application by forming such folds, the capsule must first of all be perfectly axially aligned with the bottle, i.e. for the sake of brevity, "centered"; moreover, since the capsules are generally provided with lettering and/or emblems or the like, the capsules must be correctly orientated with respect to the heads so that the folds are formed in the free spaces of the capsule, so that the lettering and/or emblems are not concealed or partially concealed by such folds.

[0004] In some applications, both the capsule and the bottle are angularly positioned, or mutually orientated, in order to align specific lettering or emblems of the capsule with any raised protrusions (emblems, coats of arms, and the like) provided on the bottle.

[0005] For these purposes application and orientation machines are used typically comprising a carousel disk for handling the bottles, which is provided with a plurality of supporting pans which can rotate and are spaced one another with a preset angular pitch, for supporting corresponding bottles to be treated in succession and a plurality of treatment heads which lie above the carousel disk, are spaced one another with the same angular pitch as the pans, and respectively and sequentially orientate the capsules, form the creases and smooth them down. The heads are supported by a support which performs continuous rotary movements, or back-and-forth strokes whose extent is equal to the spacing of the pans, and optional vertical upward and downward movements in order to move the heads from a standby position to an active position and vice versa. At least the orientating heads are provided with a rotating presser which, in the active position, presses the capsule onto the cork of the underlying bottle, which is turned by the respective supporting pan. At least respective optical readers cooperate with the orientating heads and control the rotation of the supporting pan, stopping it when a colored reference marking - known briefly as spot - provided on the capsule fitted over the bottle, is aligned with the respective optical reader. If the capsule and the bottle are mutually

angularly orientated with respect to each other, the machine also has, in addition to said optical readers, probes, usually of the mechanical type, which are adapted to detect a reference provided on the bottle, so that the capsule and the bottle are first orientated independently, respectively with reference to the spot and with respect to the probe after lifting the capsule; then the capsule is lowered back onto the bottle and is coupled thereto by the pneumatic heads or the like.

[0006] In said conventional machines, the presence of the optical readers - typically constituted by photoelectric cells - preset to detect the reference notch of the capsule and stop the rotation of the orientation pan suffers from drawbacks which substantially depend on the nature of the spot/optical reader system. As it is known, said system is in fact based substantially on the selective sensitivity of the reader, i.e. on its ability to distinguish the color of the spot from the color of the capsule, or capsule portion, on which such spot is provided; the latter color being the one that generates the threshold level that must be exceeded by the signal produced by the reader when the spot passes in order to stop the bottle. This forces the use of spots whose colors contrast considerably with those of the capsules. This condition can be met by providing the capsule with a region reserved for accommodating the spot, e.g. a black band accommodating a white spot or vice versa. However, this solution is not always compatible with the aesthetic requirements of the capsules and in any case causes a considerable increase in the manufacturing costs of the capsules, without being a decisive factor in terms of correct and reliable operation of the machine, due to false interventions which are still frequently generated by abnormal reflections or by the spot itself, whose contrast with respect to the background color of the capsule portion that accommodates it can be greatly reduced and compromised if the spot is illuminated unfavorably by ambient light.

[0007] The use of the mechanical probes for detecting the angular position of the bottle also suffers from considerable drawbacks: mainly, poor reliability and promptness of intervention, considerable structural complexity, wear and need for frequent adjustment interventions. Moreover, the probes use notches provided in the bottle, which are raised or recessed and form corresponding fragile regions in the glass of the bottle.

[0008] The aim of the present invention, starting from the notion of these drawbacks of conventional application and orientation machines, is to eliminate them. Within this aim, an object of the present invention is to improve such conventional machines by eliminating means for detecting the angular position of the bottle based on systems for color recognition of colored spots on the part of optical readers - such as typically photoelectric cells - which are sensitive to the contrast of spot/capsule colors.

[0009] Another object of the present invention is to improve conventional machines, significantly improving

their reliability by using systems for detecting the angular position of the capsule and of the bottle that are fully insensitive to ambient light and to any abnormal reflections from the surface of the capsule.

[0010] Another object of the invention is to provide conventional machines with new and improved elements for detecting the angular position of the capsule and of the bottle, which are made available and rendered economically advantageous by modern electronic and digital technologies, but are adapted for the use of positioning markings which can be easily recognized also by conventional optical detection systems fitted to any subsequent machines, such as e.g. labeling machines, which are part of the processing chain of the bottles being treated.

[0011] According to the present invention, this aim and these and other objects which will become better apparent hereinafter from the following detailed description, are achieved with a machine for applying and orientating capsules for sealing bottles of sparkling wine and the like, having the specific characteristics stated in the appended claims.

[0012] Substantially, the invention is based on the concept of replacing optical readers sensitive to the contrasting color of the angular reference spot and/or mechanical probes or the like with an artificial-vision optical means capable of detecting and recognizing the contour of a figurative pattern, termed image for the sake of brevity, which is drawn on the capsule and/or provided on the bottle and acts as a reference marking for the angular position of said capsule and/or bottle; said optical means being typically constituted by a modern television-camera sensor with a fixed-focus, fixed-aperture lens, with which a comparator circuit is associated, said circuit being adapted to compare the acquired image with one or more images stored in memory blocks of the comparator circuit, in order to validate the acquired image and consequently provide a stop signal for the orientating head.

[0013] According to another feature of the invention, at least the image that acts as a reference marking for the angular position of the capsule is formed by one or more lines and/or curves and/or contours which are associated, typically by geometric contours which are closed, overlap and/or are arranged side by side and delimit corresponding adjacent and optionally separate portions of space which, if colored adequately with respect to the background color of the capsule, are also adapted to act, as a whole, as a spot for optical readers of the conventional type.

[0014] Further characteristics and advantages of the machine according to the present invention will become better apparent from the following detailed description and with reference to the accompanying drawings, given by way of non-limitative example, wherein:

Figure 1 is an elevated sectional view, taken along an axial plane, of the machine according to the in-

vention;

Figure 2 is an enlarged-scale view of a detail of Figure 1, illustrating the detail of the artificial-vision optical sensor with the corresponding associated comparator circuit;

Figure 3 is an elevation view of a capsule with the reference marking according to the invention;

Figures 4 to 7 are views of details of variations of the reference marking;

Figure 8 is a detail view, similar to Figure 2, of a second embodiment of the machine according to the invention.

[0015] With reference to Figures 1 to 7, the reference numeral 10 generally designates a machine for applying and orientating capsules C made of metal or metallic alloy on bottles B arriving from preceding bottling stations.

[0016] In a per se known manner, the machine 10 comprises a carousel disk 11, which is turned by a hollow vertical shaft 11a, being in turn moved by a gearmotor arranged in the footing of the machine and not shown in the figure. The disk 11 is provided with a plurality of pans 12 which are angularly spaced with a preset constant pitch. Each pan is rotatably mounted on a support 13 rigidly coupled to the disk 11 and is turned by means of a belt 14 by a respective motor 15, which is preferably of the step type. A solid vertical shaft 16 is arranged coaxially to the hollow shaft 11a and is turned in alternating directions in order to perform advancement and return strokes, the angle of each stroke being equal to, or a multiple of, the angular spacing pitch of the pans 12. The shaft 16 is also subjected to axial movements in order to perform further upward and downward strokes, respectively at the end of the advancement stroke and of the return stroke. A per se known cam device, not shown, actuates the shaft 16 angularly and axially. A threaded portion 17 of the shaft 16 has a movable support 18, which can be adjusted in a vertical direction and is designed to suspend and retain at least one set of three processing heads 19, 20 and 21 (the latter not shown in the figure), which perform angular advancement and return translational motions and vertical upward and downward movements, which correspond to the similar movements of the shaft 16.

[0017] The processing heads are spaced one another by a pitch equal to the spacing pitch of the pans 12 and perform, in succession and respectively, the operations for orientating the capsules, forming the folds P (Figure 3) and clinching said folds. The processing heads 20 and 21 for forming and clinching the folds are of the conventional pneumatic type and comprise a bell-shaped support 22, which accommodates an elastomeric sleeve 23, which is subjected to the action of a compressed fluid and has, depending on the operation performed by the head, an adapted internal surface which is profiled so as to form or clinch the folds. At least the processing heads 19 for orientating the capsules are

provided with a rotary presser 24, which is subjected to the action of a weight 25 and presses, in the active position, the capsule C onto the cork of the bottle supported by the respective pan 12 keeping it centered and positioned.

[0018] An optical sensor, generally designated by the reference numeral 30, cooperates with the processing head 19 in order to control the angular position assumed by the capsule C as a consequence of the rotation imparted to the bottle by the pan 12.

[0019] According to the main characteristic of the present invention, the sensor 30 is constituted by an artificial-vision optical means which is adapted to detect and recognize the contour of a figurative pattern or image "i" which is drawn on the capsule and acts as a reference marking. Such optical means is typically constituted by a television-camera sensor with a fixed-focus, fixed-aperture lens, such as in particular the F10-S15R pattern recognition sensor marketed by the OMRON company and having for example the following functional characteristics: setting distance approximately 5 mm: focus 9.8, aperture f/2.8, 1/5-inch CCD image sensor, weight 400 g.

[0020] As clearly shown in Figure 2, a comparator circuit 31 is associated with the television-camera sensor 30 and is adapted to compare the image "i" acquired on the capsule with one or more images stored in memory blocks 32 (e.g. of the EEPROM type) of the comparator circuit, in order to validate the acquired image "i" and accordingly provide a stop signal SA for the pan 12 associated with the orientating head 19.

[0021] According to another characteristic of the invention, the image "i" acting as a reference marking is formed by one or more lines and/or curves and/or contours which are associated, typically by closed overlapping and/or mutually adjacent geometric contours which delimit corresponding adjacent and possibly separate portions of space. Figures 3 to 7 illustrate advantageous embodiments of the image, which is preferably formed by two identical rectangular contours c1-c2 which overlap but are separate (Figures 3 and 4) or by rectangular contours c3-c4 which are adjacent but have different dimensions (Figures 5 and 6) or by a rectangular contour c5 which is associated with, and adjacent to, a trapezoidal contour c6 (Figure 7).

[0022] The preference for images of the type shown in such figures arises from the fact that they delimit portions of space that, if colored adequately with respect to the background color of the capsule, are also adapted to act, as a whole, as a spot for optical readers of the conventional type. However, sensors such as 30 are adapted to recognize any image and particularly characters with or without special styling, arrows, ideograms and more generally markings whose shape has a distinctive image content.

[0023] The embodiment of Figure 8 refers to a machine adapted not only to orientate the capsule C with respect to the pneumatic head for forming the folds P

but also to perform the angular orientation of the capsule C and of the bottle B with respect to each other, so that particular graphic markings of the capsules are aligned with images of the bottle, e.g. with the image I constituted by a raised coat of arms provided on the bottle.

[0024] For this purpose, the machine has, in a per se known manner, an orientating head 240 with a sucker-type presser 241 which can move vertically and is placed at a negative pressure by an air aspiration duct 242. Such sucker-type presser allows the head 240 not only to press on the capsule during the orientation of said capsule but also to subsequently aspirate it, lift it partially and keep it rotationally motionless while the underlying bottle B is turned by the pad 12 in order to perform its angular orientation with respect to said capsule. A first television sensor 30 is arranged, and operates, as described above in order to perform the angular orientation of the capsule C, and a second television sensor 300, fully similar to the first one, is trained onto the bottle in order to capture the image constituted by the coat of arms I and stop the pan 12 when the image is aligned with the second television sensor. The second sensor 300 also sends the image I, in an appropriately digitized form, to the comparator circuit 31, which compares it with the images I' stored in the memory 32 in order to validate it and provide the signal SA for stopping the motor 15.

[0025] Without altering the concept of the invention, the details of execution and the embodiments may of course vary extensively with respect to what has been described and illustrated by way of non-limitative example without thereby abandoning the scope of the protection of the appended claims.

[0026] The disclosures in Italian Patent Application No. TO2000A000958 from which this application claims priority are incorporated herein by reference.
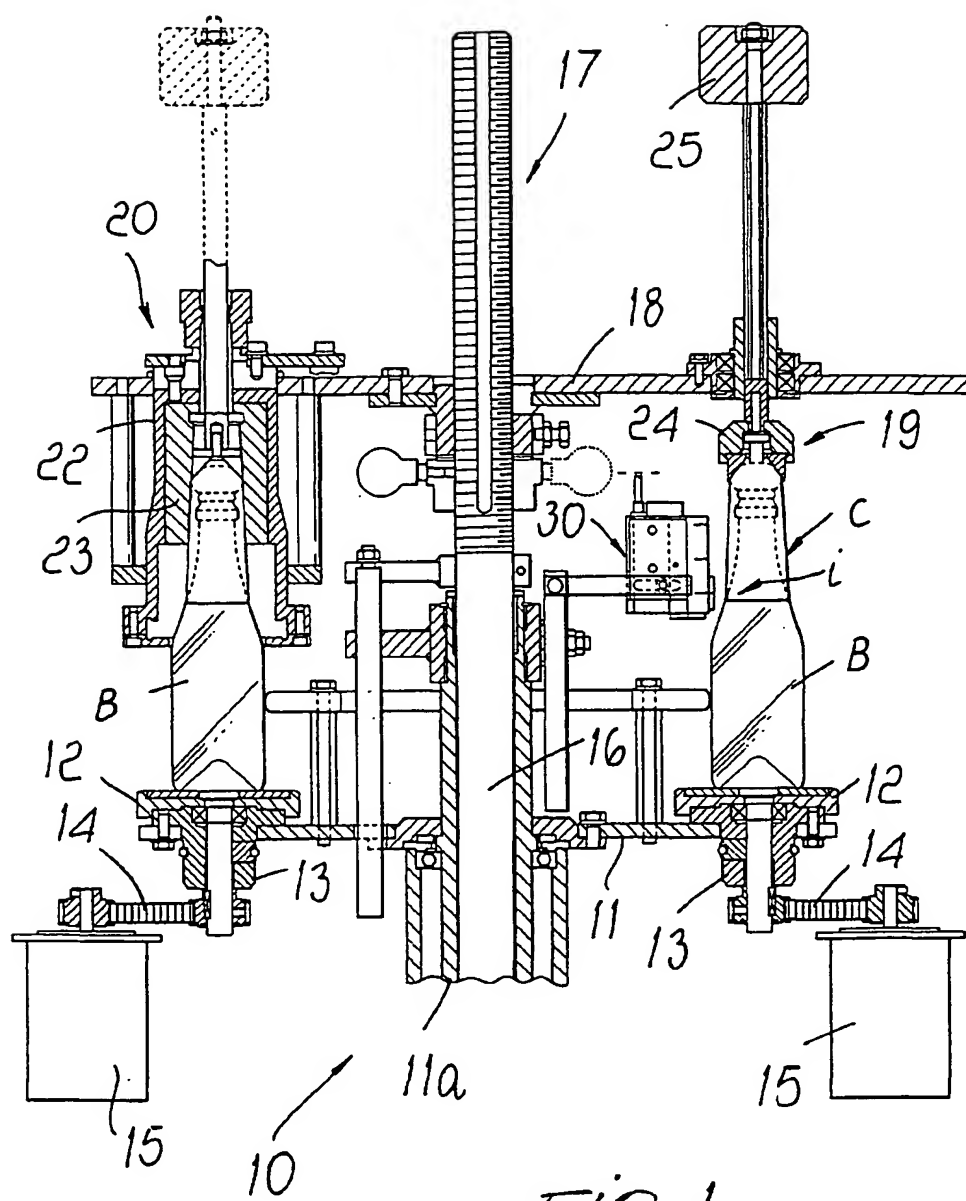
[0027] Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly such reference signs do not have any limiting effect on the scope of each element identified by way of example by such reference signs.

Claims

1. A machine for orientating and applying sealing capsules (C) to bottles of sparkling wine and the like, comprising a carousel disk (11) for moving the bottles, with rotatable spaced supporting pans (12) for supporting bottles to be processed in succession and a plurality of processing heads (19-20-21) arranged above the carousel disk and adapted to perform in succession the operations for orientating and applying the capsules by forming and clinching folds (P), and wherein at least one optical reader cooperates with the orientating head (19) and stops

the corresponding orientation pan (12) when an angular reference marking, provided on the capsule (C), is aligned with said optical reader, **characterized in that** the optical reader is constituted by an artificial-vision means (30) adapted to acquire and recognize an image (i) drawn on said capsule and acting as an angular reference marking.

2. The machine according to claim 1, **characterized in that** said artificial-vision means (30) is constituted by a television-camera sensor.

3. The machine according to claims 1 and 2, **characterized in that** said television-camera sensor (30) is of the fixed-focus, fixed-aperture type.

4. The machine according to the preceding claims, **characterized in that** it comprises a comparator circuit (31) which is associated with said television-camera sensor (30) and is adapted to compare the acquired image (i) with one or more images stored in memory blocks (32) of said comparator circuit, in order to validate said acquired image and accordingly provide a stop signal for the pan (12) that supports the bottle and/or for the orientating head (19).

5. The machine according to the preceding claims, **characterized in that** the image (i) that acts as a reference marking for the angular position of the capsule is formed by one or more lines and/or curves and/or contours which are associated.

6. The machine according to claim 5, **characterized in that** said image (i) is formed by geometric contours which are closed, overlap and/or are arranged side by side and delimit corresponding portions of space which are adjacent and optionally separate and, if colored adequately with respect to the background color of the capsule, are also adapted to act, as a whole, as a spot for optical readers of the conventional type.

7. The machine according to the preceding claims, **characterized in that** it comprises first television sensor means (30) for acquiring a first angular reference image (I) provided on the capsule (C) and second television sensor means (300) for acquiring a second image (I) provided on the bottle (B), which constitutes an angular reference with respect to which said capsule is to be orientated.
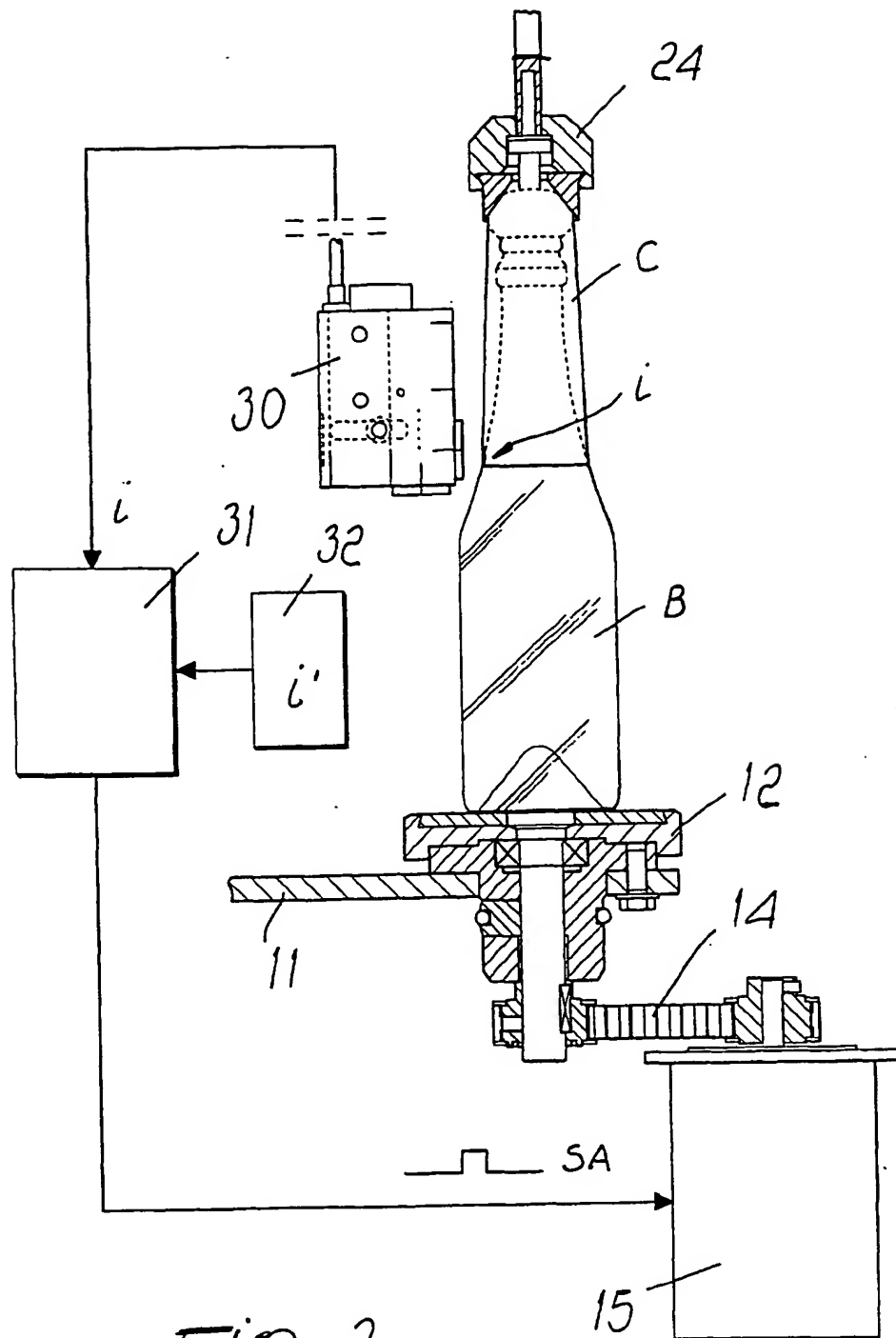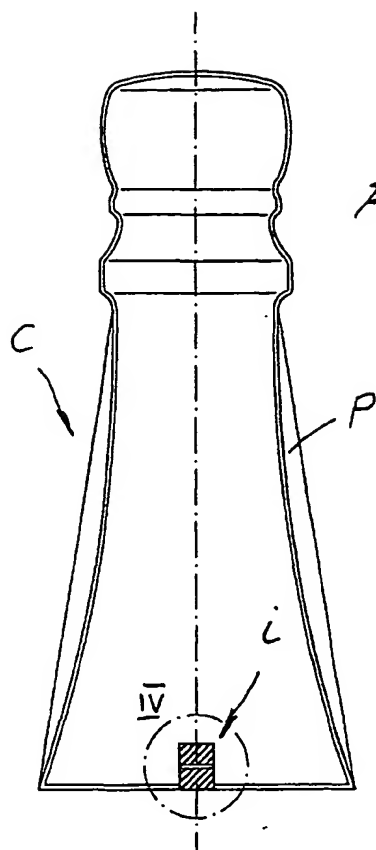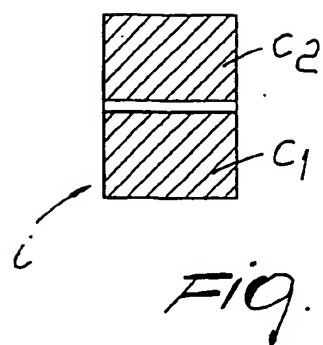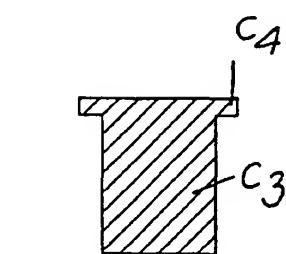
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Fig.1

24

C

i

30

31

32

i

i'

B

12

11

14

SA

15

Fig. 2

Fig. 3

Fig. 4

C

P

i

IV

i

C_2

C_1

C_4

C_3

i

Fig. 5

C_4

C_3

i

Fig. 6

C_6

C_5

i

Fig. 7

242
240
241

C

ι

30

300

I

ι

32

I'

ι'

31

B

12

11

14

SA

15

Fig. 8
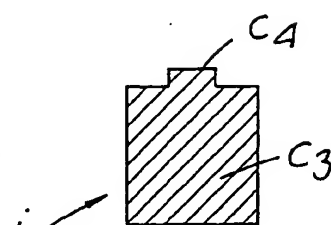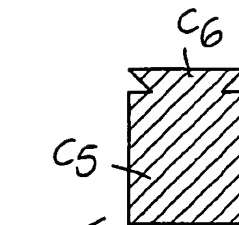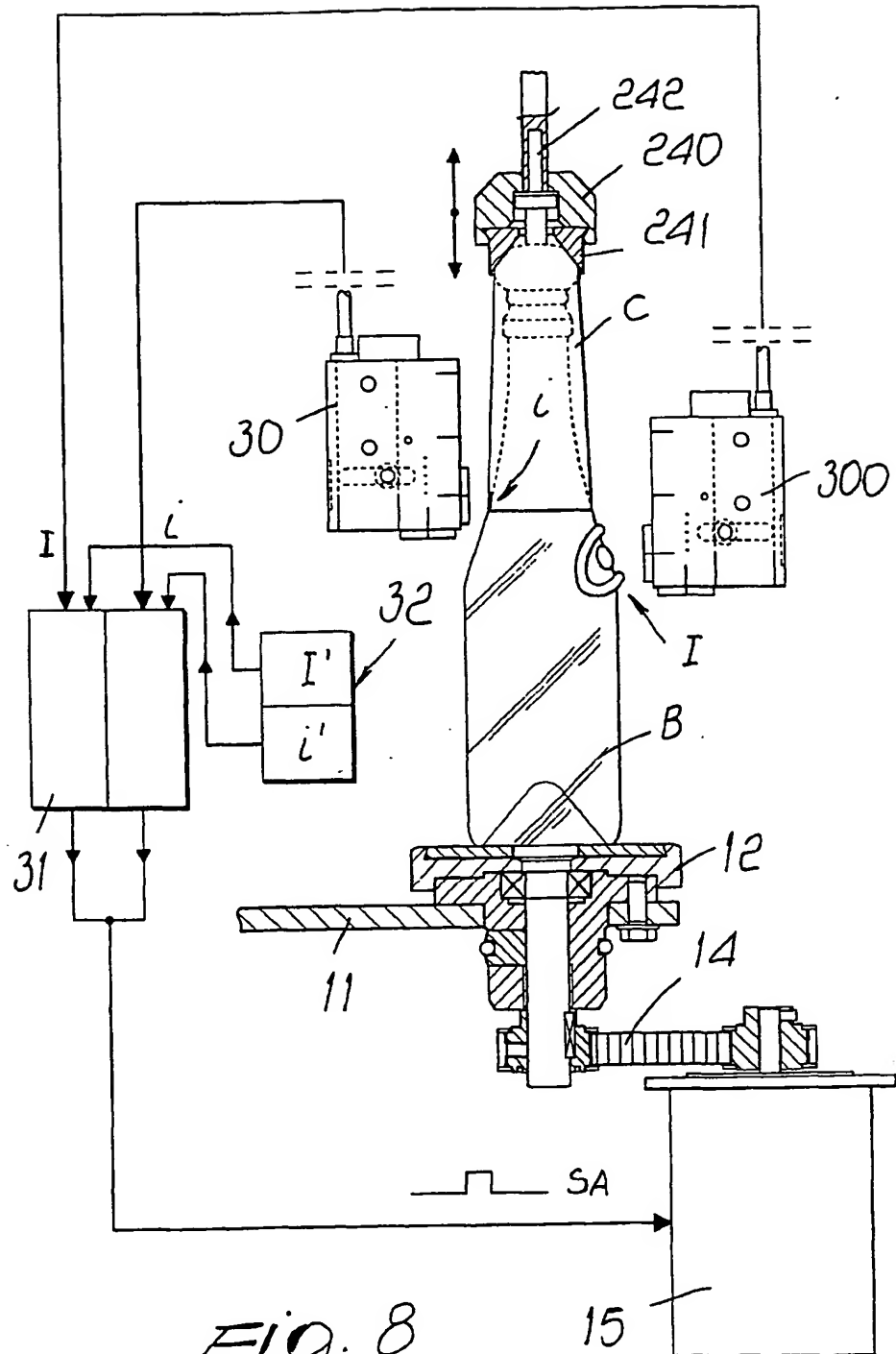
European Patent Office	EUROPEAN SEARCH REPORT	Application Number EP 01 12 1774

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
Y	EP 1 041 033 A (ROBINO & GALANDRINO SPA) 4 October 2000 (2000-10-04) * paragraph '0020!; figure 7 * * paragraph '0025! *	1-7	B67B5/03
Y	WO 98 18099 A (NORDBRYHN ANDREAS ;TOMRA SYSTEMS ASA (NO); SIVERTSEN RONALD (NO)) 30 April 1998 (1998-04-30) * page 1, line 36 - page 3, line 7; figure 2 *	1-7	
P,A	WO 01 58763 A (CAMPO SANTIAGO GARCIA ;PEREZ JAVIER GARCIA TEJEDOR (ES); ROBOTIKER) 16 August 2001 (2001-08-16) * page 10, line 16 - page 11, line 25; figure 1 *		

	TECHNICAL FIELDS SEARCHED (Int.Cl.7)
	B67B B65C G06K

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	15 January 2002	Schneider, M

CATEGORY OF CITED DOCUMENTS

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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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15-01-2002

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